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Low-Cost Production of Nanostructured Super-Thermites

Navy SBIR 2008.1 - Topic N08-020

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Opens: December 10, 2007 - Closes: January 9, 2008

N08-020 TITLE: Low-Cost Production of Nanostructured Super-Thermites

TECHNOLOGY AREAS: Chemical/Bio Defense, Materials/Processes, Weapons

ACQUISITION PROGRAM: PEO(W)-ACAT 1C

The technology within this topic is restricted under the International Traffic in Arms Regulation (ITAR), which controls the export and import of defense-related material and services. Offerors must disclose any proposed use of foreign nationals, their country of origin, and what tasks each would accomplish in the statement of work in accordance with section 3.5.b.(7) of the solicitation.

OBJECTIVE: Develop a safe, low-cost, high performance, high production rate method of preparing nanostructured super-thermite materials.

DESCRIPTION: "Super-thermite" is a metal fuel/metal oxide energetic mixture where at least one of the materials has a sub 100 nanometer dimension. Super-thermites with high energy content greater than TNT (4.5 kJ/g) are of interest. Thermite type compositions can have higher densities and energy content by volume than conventional organic explosives. This affords smaller weapon systems or enables the use of higher lethality weapons. A substantial increase in weapons performance is expected. The cost and production rate of super-thermite composites has limited the use of these materials in DoD applications. Currently, the most common approach for the preparation of super-thermites is by ultra sonication of nano metal and nano metal oxide powder. Eliminating the need for nano sized starting materials is preferable for cost minimization.

PHASE I: Determine the technical feasibility of preparing a high performance super-thermite composites in a low-cost but commercially scalable process. The material prepared by the new process should be comparable to that from the ultra sonication method. Capability to determine the performance of the super-thermite material by measuring the reaction rate, time to peak pressure, maximum peak pressure, and energy content is preferred.

PHASE II: Develop a prototype production system capable of producing nano-structured thermite with performance comparable to material from the sonication method. Demonstrate the preparation of several moderate scale batches and measure the performance characteristics as compared to material from the sonication process. Run to run reproducibility is required. Determine the aging and safety characteristics of the prototype prepared super-thermite material.

PHASE III: Develop a production ready system to support the development and integration of the super-thermite material into smaller weapons for the JSF internal weapons carriage, as primers for NAVAIRï¿½s medium caliber Gatling gun ammunition, for use in CAD/PAD devices such as ejection seats and flare dispensers, and as flare materials.

PRIVATE SECTOR COMMERCIAL POTENTIAL/DUAL-USE APPLICATIONS: Low-cost super thermite has potential applications as lead-free primers for ammunition, igniters, flares, and fireworks, especially indoor displays.

REFERENCES:

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KEYWORDS: energetics; nanostructured; super-thermite; pyrotechnics; ultra sonication; nano metal

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